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Response to the UK Parliament Energy and Climate Change Committee, Enquiry on Carbon Capture and Storage (CCS)

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1. Summary of Main Points

Our submission focuses upon public perceptions of, and engagement with, CCS. This issue has risen in importance since proposed CCS projects at Barendrecht (Netherlands), Beeskow (Germany) and Greenville (USA) stumbled in large part due to public opposition. The proposed Hunterston power plant + partial CCS development in Scotland encountered strong local and NGO opposition and partial CCS at the proposed new Kingsnorth coal power plant did not ameliorate NGO furore. Some claim that offshore CO₂ storage will be of no (or minimal) concern to the public but this ignores Brent Spa, the legacy of the Gulf of Mexico drilling disaster, controversies over offshore renewables development, the necessary onshore infrastructure and the importance of values which do not correspond with land/sea boundaries. CCS has become a prism for the playing out of different values about our energy future – to what extent should it depend upon large centralized power plants rather than much more distributed generation? To what extent should it continue to depend upon coal? Will CCS lock us more deeply into the fossil fuel economy, beyond which we urgently need to progress according to many; or might CCS provide us with the breathing-space to develop renewables – a sort of bridge to a genuinely sustainable low-carbon energy future? How long should that bridge be and could it be forever extended as policy makers and industry invest more into expensive fossil fuel and CCS infrastructure? What is the risk of CO₂ stores in rock formations leaking? Such questions rapidly emerge when members of the public participate in discussion and focus groups on CCS. Most of these questions cannot be answered by scientists and herein lies a problem since there are precious few avenues for the public to have a debate about what role CCS might have in the near and medium-term future and its relative importance vis-à-vis other low-carbon options such as renewables, energy efficiency, demand reduction and nuclear. We review what is known about public perceptions of CCS and provide recommendations to Government and developers on how to better engage with publics for more resilient decision-making in terms of both process and outcome.

2. Introduction

We are social scientists who have been working on CCS policy, public perception and technology assessment issues since 2000 (Shackley), 2009 (Evar) and 2011 (Mabon). In addition to past work for Tyndall, DECC and IEA, we have been involved in recent projects such as EU SiteChar (a 5-day citizens' panel on perceptions of CCS in Moray, NE Scotland) (2010-12), EU ECO₂ (public and stakeholder perceptions of offshore CO₂ storage in Scotland and Yorkshire & Humberside) (2011-2015) and the Global CCS Institute-funded Large Group Process on public perceptions of low-carbon energy technologies (involving 100 members of the Edinburgh public) (2011)

(<http://www.globalccsinstitute.com/publications/public-perceptions-low-carbon-energy-technologies-results-scottish-large-group-process>). We are happy to supply the Committee with papers, reports and other documentary material upon request.

3. Overview of Findings on Public Perceptions

- In this note we limit ourselves to consideration of the social issues surrounding development of large-scale integrated CCS projects.
- It is well known that adverse public reactions to a number of large CCS projects internationally contributed to their early termination. The best known example is Shell's proposed CCS facility at Barendrecht (Netherlands), but other examples are Vattenfall's proposed facility at Beeskow (Brandenburg, Germany) and public opposition to the US-based projects in Greenville (Ohio) and Carson (California). A detailed analysis of past CCS projects internationally and analysis of the public perceptions and controversies can be found in Hammond, J. and Shackley, S. (2010), *Towards a Public Communication and Engagement Strategy for Carbon Dioxide Capture and Storage Projects in Scotland: A Review of Research Findings, CCS Project Experiences, Tools, Resources and Best Practices* (159pp, written for the Scottish CCS Initiative, Phase II) (<http://carbcap.geos.ed.ac.uk/website/publications/sccs-wp/wp-2010-08.pdf>). A useful review and analysis of European experience is in the paper Otra et al. (2012), 'Public response to CO₂ storage sites: lessons from five European cases', *Energy & Environment* 23(2/3): 227-248).
- Why do (sections of) the public object to planned CCS projects and to the idea of CCS as a climate change mitigation option? There is no single reason but we can perhaps identify the following.
- Value-differences on energy futures. Some people prefer to see a decentralised electricity supply system based on renewables rather than a continuation of the existing reliance on gas and coal in a centralised system, which CCS implicitly supports. Some people are also concerned that a strong focus on technological 'fixes' overlooks the need for behavioural change, and would prefer to see more emphasis on energy efficiency.
- Value-differences on use of coal. Some people object to the continued extraction and use of coal. Even if electricity generation from coal could be made much less carbon intensive, coal extraction and use involves additional environmental pollutants that have adversely affected e.g. mining communities around the UK.
- Value-differences focused on the instrumental / efficiency of CCS versus climate change focused environmental values. Some people bristle at the concept that CCS power plants reduce the efficiency of fossil fuel use, hence requiring more coal extraction, transport and preparation and burning for exactly the same output as pre-CCS. Others find the concept of storing CO₂ in rock formations to be wasteful and hold out for a more productive use of captured CO₂, and are concerned that it might constitute an environmental burden for future generations.
- Distrust of CCS with respect to future use of coal. Some people are suspicious of CCS because they believe that it is used as a convenient rationale to justify construction of new coal power plants, which are unlikely to ever have CCS installed to 100% of the flue gas outputs (and probably to a much lower percentage). Hence, according to this perspective, CCS could

actually increase net CO₂ emissions relative to no CCS. The use of captured CO₂ for enhanced oil recovery (EOR) may serve only to enhance these concerns about CCS perpetuating a fossil fuel economy. The UK's current carbon capture and readiness policy may do little to alleviate these concerns as requirements for additional upfront investment in capture kit are minimal.

4. Four Levels of Justification

Figure One shows four ways of justifying project approval.

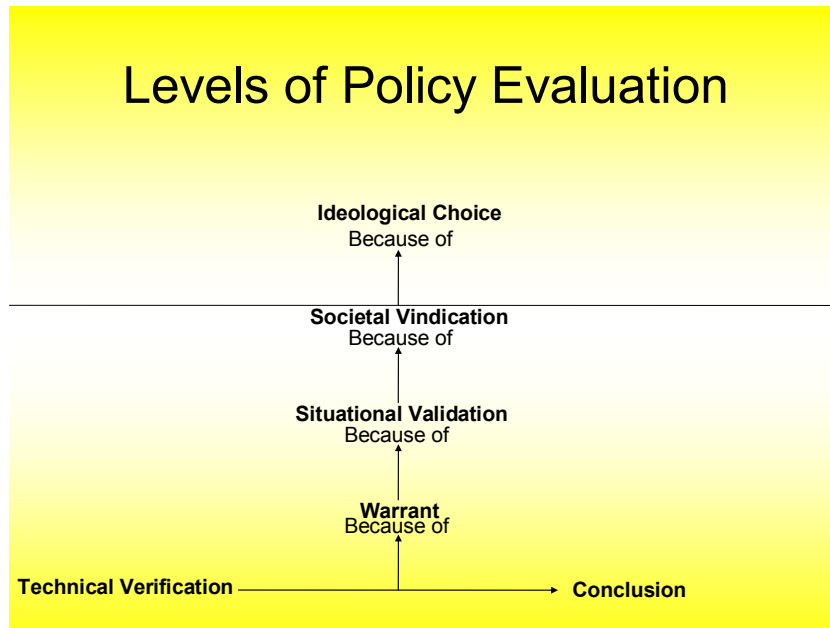


Figure One: Four Levels for Justification of Project Selection (after Frank Fischer)

- Technical Verification – has an appropriate risk assessment been undertaken? Many questions have been raised about technical uncertainties associated with CO₂ geological storage (CGS), in particular the risk of leakage and monitoring. The relevant technical communities have not always responded well to questioning on risks, with some scientists tending to present a blanket view that 'there is no risk of leakage', a position which is not easily defended by recourse to scientific argument because uncertainty regarding the long-term consequences of CO₂ storage and impacts of leakage remains. (When challenged, such scientists have responded, 'there are no risks because we will make sure we don't store CO₂ where there could be risks of leakage'. However, this answer is only convincing if the audience already have a high level of trust in the scientists – which cannot be assumed). The common response by geoscientists has bred suspicion from members of the public that they are not 'hearing the whole story' and are being fed a sanitised version of a more complex reality.
- Situational Validation – is it appropriate to locate the facility here? In the case of Barendrecht, one source of opposition was that the community perceives that the town already suffers from excessive infrastructure and the idea of even more development

was unpopular and unfair ('why should we have to put up with even more development?'). In other cases, the reason for objecting to the location is its unspoilt and rural character.

- Social Vindication – is CCS an appropriate part of energy policy? Does using decarbonised fossil fuels really help us move to a sustainable energy system or does it merely prolong our reliance on fossil fuels and reduce incentives for a more radical transition? Will CCS lock-us further into the fossil fuel economy and reduce incentives for developing non-fossil alternatives by 'letting us off the hook' and believing we've solved the problem? Isn't CCS solving the symptoms of the problem rather than the root cause? The public are interested in discussing such questions (as was patently evident from the SiteChar Moray citizens' panel, see *Moray Focus Conference Report*, 2012) (<http://www.sitechar-co2.eu/Sections.aspx?section=558.558.583.584>) and frustration is sometimes expressed that there is not a way of engaging with policy makers on energy policy issues. Where there is no formal way of discussing national-level policy (e.g. through the usual representative democratic channels), or any such opportunities are perceived as being very limited, some members of the public will attempt to raise energy policy issues and related concerns during local planning disputes.
- Ideological choice – Is energy policy consistent with peoples' ideological beliefs? Despite decades of scientific assessments, large swathes of the public still do not share in the IPCC's consensus on anthropogenic climate change (ACC). Rather than continuing to try and persuade the public through yet more 'authoritative' assessments of 'scientific consensus', it is more useful to understand that different ideological positions are rooted in fundamentally different values. If people do not believe in ACC will they accept CCS? Figure Two illustrates the rather complex foundations for support in CCS, all the way from believing in ACC to accepting the need for continued use of fossil fuels as a key component of the fuel mix. If any of these foundational levels are not accepted, the case for CCS is weakened. (Where CO₂ is used for Enhanced Oil Recovery and subsequently stored, a direct finance revenue-raising rationale can emerge, but EOR-CCS currently looks too expensive in the North Sea context. There are also suggestions that EOR-CCS reduces support from NGOs who were previously cautiously supportive of CCS as a bridging climate change mitigation technology.)

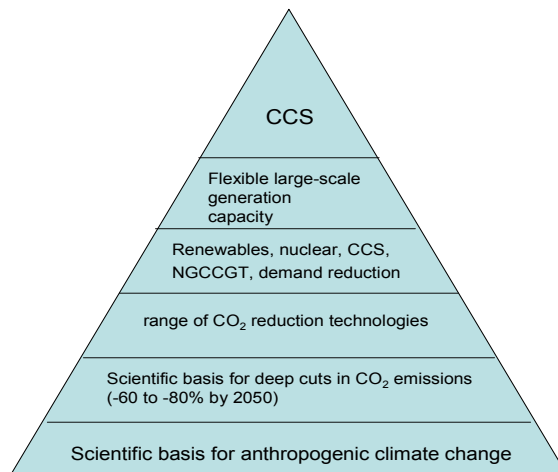


Figure Two: The CCS Rationale Pyramid (source: Markusson, Shackley, Evar, The Social Dynamics of Carbon Capture and Storage, Routledge, 2012)

http://books.google.co.uk/books?id=NvRNqzMrwMC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

5. Due Process

- A further source of opposition is related to procedural conduct and effective project management. Here the question is not so much 'are they [companies, the government, scientific advisors] trustworthy' but rather 'are they competent'? For example, if processes for participation are not effectively designed or implemented, distrust in the institutional capacity for listening and responding to public concerns will become evident. An example from Barendrecht is when it took one year for the developer to provide an answer to a question on the project from a local representative. Whatever the reasons for such a long delay, the perception can readily arise that the developer and/or government is either not listening or is incompetent.
- Related to the above point, opposition may arise if publics perceive CCS deployment to be a 'done deal' by the time engagement commences. As seen with the Moray Citizens' panel on CCS and early public consultation for the QICS experiment (www.bgs.ac.uk/qics) in west Scotland, opposition may arise if publics get the impression that participation in an engagement process is unlikely to have any real effect on the outcome of the project, or if decisions about use of the environment around them have been taken without their consultation.
- Finally, members of the general public have expressed concerns that scientists involved in CCS research have vested interests in the development of plant and policies in support of widespread implementation. Such concerns may be alleviated by having scientists communicate their reasons for being involved with the research to the general public. However, similar to the point raised about poor communication in the case of Barendrecht, not all attempts at communication are equal and shows of competence and trust are central

to ensure a good dialogue.

6. Examples of Effective Public Engagement

- Not all CCS projects have resulted in public controversy. Examples of successful public engagement include the planned Futuregen project in the USA (which did not, however, proceed due to funding changes); and the on-going Decatur (Illinois) ADM project utilising CO₂ from fermentation. So what explains such successes? As with the failures, there are likely to be multiple explanations but a few reasons are as follows.
- Provision of new employment opportunities in areas of industrial decline and high unemployment.
- Development of close relationships between companies and trusted higher and further educational institutions, where such connections can foster effective relationships and communication channels between local residents, community leaders, developers, government officials and regulators. An example here is at the Decatur facility (Illinois) which enjoys a close education and training relationship with Richmond Community College, including prominently around CCS technologies;
- History of fossil fuel/hydrocarbon industry in area. An example here is the north-east of Scotland around Aberdeen, where many of the companies likely to be involved in offshore storage are known to local communities as 'good and trusted' employers (who pay well) through a long history of generally safe involvement in the oil and gas industry. (<http://oceanrep.geomar.de/20606/1/Mabon.pdf>) However, as the case of Barendrecht shows, this should not be taken to mean CCS will be able to be deployed without contestation – and it may also be the case that the economic/employment benefits have been unevenly distributed within the host communities. Invitations to members of the public in early project consultations may likewise alleviate criticism that decisions have been made prior to consultation rounds.

7. Improving Public Engagement on CCS

- How can public perceptions and engagement be improved? A full list of recommendations is provided in the above-mentioned Hammond & Shackley report. Figure Three summarises the key steps that any developer should consider when devising public engagement strategies on CCS. While there is a wide range of practice, many developers do not yet engage publics, communities and community leaders as actively as desirable or at an early enough stage in the project life cycle. There is a frequent desire by developers to 'control' and 'manage' public engagement processes but such attempts can often be counter-productive as it can come across as over-bearing and an effort at persuasion rather than really listening and responding to what is heard. Consensus is not usually possible or necessarily desirable – but what the public do expect is to have their concerns and feelings heard and taken seriously and for a due process to consider different opinions before coming to a decision.
- It is important for developers to attempt to understand early on the grounds on which publics and stakeholders actually form their opinions on CCS, and tailor subsequent engagement

accordingly. Communication of the science behind climate change and CCS, and attempts to dispel any 'myths' about the safety of CCS, are unlikely to be effective on their own if it is issues of fairness, justice or values that are driving publics' concerns. Processes such as social site characterisation can help to understand this context

(<http://oceanrep.geomar.de/20601/>)

- CCS perhaps struggles in that the usual rationale for its acceptance is relatively tightly bounded and rests on a linear sequence of assumptions. Compare this to, say, wind power, which is justified by developers in terms of energy security, declining costs over time, pride in innovation and permanence of supply as well as environmental benefits. It may thus be helpful to imagine alternative 'pathways' to engagement on CCS, for example energy security, reducing pollution and so on that can engage a wider range of actors.
- Such pathways could conceivably include bioenergy CCS (BECCS) systems that theoretically have the potential to lead to negative CO₂ emissions (though ensuring biomass feedstock sustainability is critical given that the vast majority of biomass would be imported into the UK); CCS for EOR, to decrease dependence on imported oil (this does however raise the criticism that CCS systems would directly lead to greater emissions); and pre-combustion capture integrated with hydrogen networks to provide a relatively low-carbon form of electricity supply.

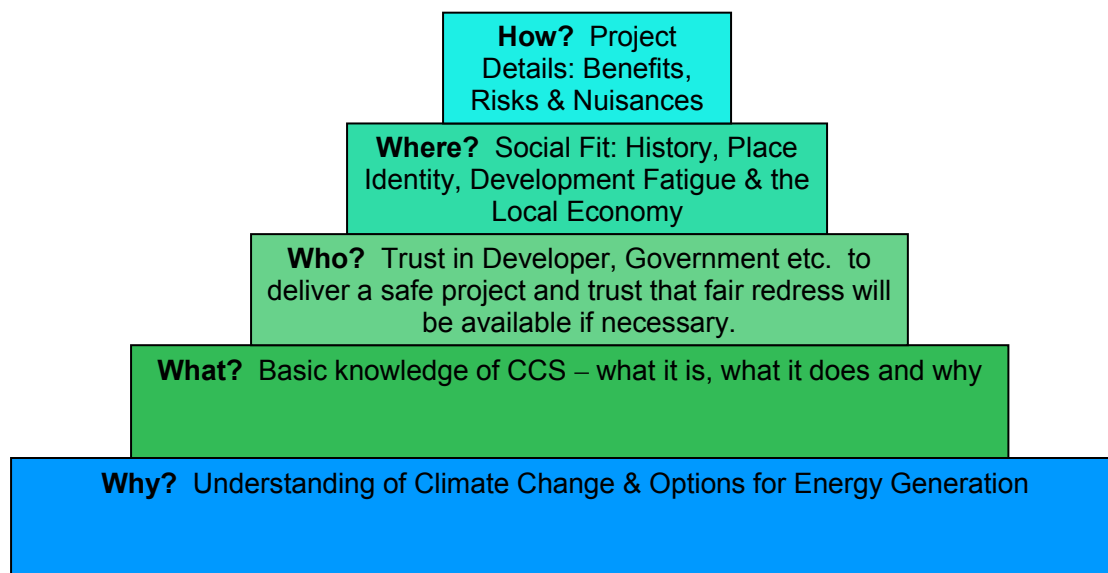


Figure Three: Steps towards public acceptance of CCS projects (source: Hammond & Shackley, 2010)

- A lively debate is now underway concerning whether local communities should be compensated for bearing the burden of energy infrastructural developments such as wind, nuclear and hydraulic fracturing. It has been proposed that a financial sum could be transferred to a legitimate local organization, or to a public body such as local authority or agency, to spend to improve and enhance local communities, facilities and (wanted)

infrastructure (cycle lanes, sports centres, swimming pools, play areas in parks, nature reserves, etc.).

- This sort of compensation in return for accepting energy infrastructure projects is already commonly practiced in some countries such as the USA, Australia and France. There are different viewpoints on this complex issue, with some concerned at attempts to 'bribe' communities into accepting projects. Where there is already structural inequality and a concentration of facilities such as power plants, pipelines, electricity pylons and overhead cables, landfill and other waste repositories, the addition of a CO₂ capture plant and associated pipelines would need to be examined very carefully and any compensation package scrutinized to ensure that a vulnerable community is not being manipulated.
- Perhaps an overarching point about how developers can 'do' engagement better relates to striking the balance between the possibility of making tangible changes to the project as a result of dialogue, versus the realities of decision making (physical limitations to storage sites, complexity of political processes). Starting engagement early whilst some of the project details are still open for discussion, but at the same time being clear from the outset about what participation can and cannot hope to achieve, would be a real advance on current practice. Such early dialogue might also indicate what types of compensation would be appropriate and this could potentially entail a package of low-carbon options such as energy efficiency in local housing, decarbonising personal transport, behavior change and community action, etc., to avoid the criticism identified in social science research that CCS solves the symptoms not the root cause of the climate change problem.